

SYSTEM AND METHOD FOR DISPLAYING AND
MANIPULATING MULTIPLE CALENDARS ON A
PERSONAL DIGITAL ASSISTANT

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CROSS REFERENCE TO RELATED APPLICATIONS

10 The present application is related to co-pending applications entitled
“System and Method for Synchronizing Multiple Calendars over a Wide Area
Network” by Inventors Alvin Pivowar, Steve Hanrahan and Pete Grillo, ~~attorney~~
~~number 09/1289,764~~^{serial}
~~docket number PFTRP003~~, filed concurrently herewith, and incorporated herein by
reference; “System and Method for Sharing Data Among a Plurality of Personal
15 Digital Assistants” by Inventors Alvin Pivowar, Steve Hanrahan and Pete Grillo,
~~Serial number 09/1289,721~~
~~attorney docket number PFTRP005~~, filed concurrently herewith, and incorporated
herein by reference; “System and Method for Synchronizing Data Among a
Plurality of Users Via an Intermittently Accessed Network” by Inventors Alvin
Pivowar, Steve Hanrahan and Pete Grillo, ~~Serial number 09/1289,769~~
~~attorney docket number PFTRP004~~, filed
20 concurrently herewith, and incorporated herein by reference; and “System and
Method for Advertising during a Data Transfer Process” by Inventors Alvin
Pivowar, Steve Hanrahan and Pete Grillo, ~~Serial number 09/1289,273~~
~~attorney docket number PFTRP006~~, filed
concurrently herewith, and incorporated herein by reference.

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FIELD OF THE INVENTION

30 The present invention relates generally to displaying calendars on personal
digital assistants and, more particularly, to a system and method for effectively
controlling the presentation and manipulation of calendars on a personal digital
assistant.

BACKGROUND OF THE INVENTION

5 Personal digital assistants, or PDA's, are commonly known hand-held computers that can be used to store, display, and/or manipulate various personal information including, but not limited to contact information, calendar information, etc. Such information can be downloaded from other computer systems, or can be inputted by way of a stylus and pressure sensitive screen of the PDA or any other
10 type of input device such as a mechanical keyboard or a voice recognition module. Examples of PDA's are the Palm™ computer of 3Com Corporation, and Microsoft CE™ computers which are each available from a variety of vendors.

15 Unlike PDA's, conventional desktop computers, in the past, have allowed the storage and manipulation of multiple calendars thereon. This capability has been prompted by the fact that desktop computers are commonly utilized by multiple users. Further, desktop computers are traditionally equipped with the technical features that are necessary to enable such functionality.

20 For example, a desktop computer commonly runs software that is capable of allowing various users to share a total capacity of the computer. This may be done by allowing each user to log on and retrieve, add, modify, and delete information, i.e. calendars, that are unique to such user. In terms of technical features, desktops are equipped with an abundance of memory which may be allocated to the calendars
25 of each of the different users. Also, screens of desktop computers are typically have larger than 12" in size. This even allows multiple calendars to be displayed if desired.

30 Networking of computers has augmented the number of calendars that may be stored on one computer. For instance, a plurality of users may be networked to a single computer, or server, which stores calendars for the users. During operation, each of the users may utilize the server in order to access and manipulate his or her

calendar. One example of this can be found on the Internet, wherein various client computers may be connected to the Internet and access one of a plurality of calendars on a single server via a web site.

5 The Internet has also allowed multiple users to access a single shared group calendar. Such system permits each user to view and edit various scheduled matters on the single calendar. As an option, an electronic message may be sent to each of the users of the group each time the shared group calendar is edited.

10 In sharp contrast, PDA's currently do not allow the display, let alone the storage of multiple calendars. This is a result of both the limited intended purpose of PDA's and also various technical limitations. For instance, PDA's are traditionally employed for the storage and manipulation of personal data, hence the name personal digital assistant. As such, PDA's conventionally allows the storage of only 15 a single personal calendar.

Even if the storage of multiple calendars on a PDA were desired, many technical obstacles prevent such implementation. This is at least partly due to the portable nature of PDA's which mandates that the various components of PDA's, 20 including the displays, are extremely compact. This feature tends to preclude a feasible method of displaying the multiple calendars in a way that such information may be effectively read and manipulated.

Up to now, the intended purpose and various technical limitations of PDA's 25 has restricted the use of only one calendar per PDA. This has limited PDA users to only organizing his or her own scheduled matters without regard to the scheduled matters of others. Inherent in this limited system is a potential for increased disorganization amongst various PDA owners who interact in normal everyday life.

There is thus a need a system and method for storing multiple calendars on a PDA and further allowing the display of such calendars to enable effective retrieval, addition, modification, and deletion of the calendars.

DISCLOSURE OF THE INVENTION

5 A portable, hand-held personal digital assistant (PDA) is provided for simultaneously depicting multiple calendars on a single display. The PDA includes a portable, hand-held housing including a top face, a bottom face, and a side wall therebetween for defining an interior space. An input device is situated on the top face of the housing for allowing input of data. Associated therewith is a display

10 situated on the top face of the housing for depicting data. Situated in the interior space of the housing is memory for storing a plurality of calendars each including a plurality of scheduled matters. Finally, control circuitry is situated in the interior space of the housing and connected between the input device, the display, and the memory. The control circuitry serves for simultaneously depicting a plurality of the

15 calendars on the display. The controller is further adapted for executing multiple methods to facilitate the simultaneous display of the calendars on the display of the PDA. By conveniently displaying the multiple calendars, the present invention allows a user to more effectively manipulate the same.

20 In order to allow the storage, display, and manipulation of the calendars, the calendars and scheduled matters may be stored in separate calendar databases. Further included is a common database including a plurality of identification data sets each corresponding to the calendar of one of the calendar databases. Such identification data sets each include attributes corresponding to the associated

25 calendar database. Examples of such attributes may indicate that one of the calendars is selected, a primary calendar, read only, and/or a foreign calendar. In operation, the calendars of the calendar databases in accordance with the attributes that are stored in the common database.

30 Further, various methods may be employed to display the calendars to allow more effective manipulation. For example, in one embodiment of the present

invention, at least one calendar is depicted along with a plurality of icons each corresponding to increments of time, i.e. hours, days, and weeks. Next, the present invention allows the selection of one of the icons after which the calendar is divided into increments of time corresponding to the selected icon. As an option, the 5 selected icon is enlarged upon a plurality of calendars being displayed simultaneously.

In another embodiment, upon the selection of a designated icon, a window is depicted which identifies each of the calendars and allows the selection of the 10 calendars by way of any graphical interface such as check boxes. Thereafter, the selected calendars are displayed. While the selected calendars are being displayed, any of the selected calendars may be replaced with another calendar using a pull-down window.

15 In yet another embodiment, each calendar that is displayed is divided into sections corresponding to increments of time. Further, the scheduled matters are depicted in the sections. In use, a size of the sections is altered as a function of a number of the calendars simultaneously depicted so as to allow a sufficient amount of space for depicting the scheduled matters.

20 In accordance with still yet another embodiment, a user is allowed to move the scheduled matters of one of the calendars to another one of the calendars. This may be accomplished by dragging the scheduled matter on the display between the calendars.

25 These and other advantages of the present invention will become apparent upon reading the following detailed description and studying the various figures of the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, aspects, and advantages are better
5 understood from the following detailed description of a preferred embodiment of the
invention with reference to the drawings, in which:

10 ~~Figure 1 is a perspective view of the personal digital assistant of one embodiment of the present invention;~~

15 ~~Figure 2 is a schematic diagram showing the interconnection of the various electrical components of the personal digital assistant of Figure 1;~~

20 ~~Figure 3A is an illustration of a user interface display of the present invention showing the various features associated therewith;~~

25 ~~Figure 3B is a diagram illustrating a method of displaying multiple calendars on a display the personal digital assistant of Figure 1 in accordance with one embodiment of the present invention;~~

30 ~~Figure 3C is a block diagram illustrating a data structure in accordance with one embodiment of the present invention;~~

~~Figure 4 is a flowchart illustrating a method of simultaneously displaying multiple calendars on a display of the personal digital assistant of Figure 1;~~

~~Figure 5 is a flowchart illustrating operation 408 of Figure 4 in greater detail;~~

~~Figure 6 is a flowchart illustrating operation 516 of Figure 5 in greater detail;~~

Figure 7 is a flowchart illustrating operations 410 and 506 of Figures 4 and 5, respectively, in greater detail;

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Figure 8 is a flowchart illustrating operation 412 Figure 4 in greater detail;

Figure 9A is an illustration of a user interface display of the present invention showing a single calendar in increments of hours;

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Figure 9B is an illustration of a user interface display of the present invention showing a pair of calendars in increments of hours along with a marked duration of a scheduled matter;

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Figure 9C is an illustration of a user interface display of the present invention showing window for selecting which calendars are to be displayed simultaneously;

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Figure 9D is an illustration of a user interface display of the present invention showing window for selecting which calendars are to be displayed simultaneously, wherein an additional calendar is selected by way of a check box;

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Figure 9E is an illustration of a user interface display of the present invention showing three calendars in increments of hours, wherein the sections corresponding to each increment of time is augmented since a large number of calendars are displayed at once;

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Figure 9F is an illustration of a user interface display of the present invention showing one calendar in increments of hours with a marked duration of a scheduled matter along with descriptive text; and

Figure 9G is an illustration of a user interface display of the present invention showing a pull-down window for selecting one of the calendars to be displayed.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

5 With reference to Figure 1, a preferred embodiment of the present invention includes a personal digital assistant (PDA) 100. As shown, the PDA 100 includes portable, hand-held housing 102 having a top face, a bottom face, and a side wall therebetween for defining an interior space. Situated on the top face of the housing 102 is an input device 104 which is adapted for allowing input of data. Associated therewith are a plurality of pushbuttons 108 also for input purposes. A display 110 is situated on the top face of the housing 102 for depicting data. It should be noted that the pushbuttons 108, input device 104, and/or the display 110 may be amalgamated into a single device.

10 As shown in Figure 2, memory 112 is typically situated in the interior space of the housing 102. In use, the memory 112 serves for storing a plurality of calendars each including multiple scheduled matters. As shown, the memory 112 may take the form of a DRAM or ROM. Also included is a controller 113 situated in the interior space of the housing 102 and connected between the input device 104, the display 110, and the memory 112 via at least one bus 116. It should be noted that the controller 113 may include a microprocessor and accompanying software stored in the memory 112. Alternatively, the controller 113 may take the form of any hardware and/or software combination that is capable of controlling the various components of the present invention in order to carry out the intended functions.

15 In one embodiment, the PDA 100 may include a hand-held PalmTM PDA available from 3Com Corporation or a Microsoft CETM computer. In the alternative, the PDA may take the form of any other type of portable data storage module which is capable storing, editing, and/or synchronizing sets of personal data. This may be 20 accomplished by any type of I/O mechanisms including, but not limited to a display 110, a plurality of push buttons, a keyboard, a data port, an electronic writing pad

using a stylus 106, a voice recognition unit, and/or any other type of I/O device capable of inputting and/or outputting personal data. It should be noted that any of the foregoing I/O devices may be mechanical in nature or, in the alternative, be incorporated into a "touch-sensitive" display.

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During use of the PDA 100 of the present invention, various features are displayed during operation in a "calendar" mode. For example, as shown in Figure 3A the display 110 generally includes a header 120 including a day selector bar 122 having a plurality of day select icons 124, a current date field 126, and a calendar select icon 128. Below the header 120 is a plurality of data fields 129 each corresponding to specific times which are identified by time identifiers 130. The data fields 129 also have a calendar heading 132 and an associated pull-down icon 134 positioned thereabove for reasons that will become apparent hereinafter.

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15 With continuing reference to Figure 3A, positioned along a lower portion of the display 110 is a time increment selector bar 136 including three time increment icons 140 each corresponding to a unique time increment. Ideally, the icons of the time increment selector bar 136 include three squares each having a number of indicia elements that corresponds to an associated time increment. It should be noted that when selected, the day select icons 124, time increment icons 140, and time identifiers 130 may be highlighted or otherwise distinguished with respect to the remaining icons and identifiers. Also shown in Figure 3A is a new button 142, a details button 144, and a goto button 146.

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25 It should be noted that while the calendars are being displayed, a user may utilize any one or more of the I/O devices to create, edit, modify various aspects of the calendar information such as data, security rights, or sharing rights. In various alternate embodiments, the foregoing principles may also be applied to other information such as contact information.

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Figure 3B generally shows the operation of one embodiment of the present invention. In use, the controller of the PDA 100 is adapted for allowing a user to simultaneously depict a plurality of the calendars 146 on the display 110. This is accomplished by permitting operation in a plurality of states. For example, in a first state 300, a single primary, or default, calendar is displayed. A second state 302 is used to depict a single calendar other than the primary calendar. In still yet another state, a third state 304, a plurality of calendars may be depicted.

During use, a user may maneuver between the various states by selecting certain items on the PDA 100. For example, while in the first state 300, a user may shift to the second state by selecting the pull-down icon 134 which in turn provides a pull-down window for allowing the selection of any available calendars in place of the primary calendar in the second state 302. In the alternative, the calendar select icon 128 may be selected which provides a separate full-size window for allowing the selection of multiple calendars to be displayed simultaneously in the third state 304. Further details regarding the operation of the pull-down window and full-size window will be set forth later.

While in the second state 302, the pull-down icon 134 may be used in a manner similar to that in the first state 300 in order to select one of the available calendars in place of the currently displayed calendar. Further, the calendar select icon 128 may be selected to provide the full-size window for allowing the selection of multiple calendars to be displayed simultaneously in the third state 304.

In the third state 304, the pull-down icon 134 of any of the calendar headings 132 can be used in a manner similar to that in the previous states in order to select one of the available calendars in place of the currently displayed calendars. Further, the calendar headings 132 may be selected for reverting to the second state 302, wherein a single calendar is displayed.

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As shown in Figure 3B, in each of the states, the calendars may be divided into various selected increments of hours, days, and weeks. It should be noted that the calendars may include any type of calendars including a sports calendar, a personal calendar, a work-related calendar, and/or another person's calendar. Such 5 calendars may be manually inputted, downloaded, or synchronized in any fashion.

Figure 3C is a block diagram illustrating a data structure which facilitates the display of multiple calendars on a display 110 of the PDA 100 of Figure 1. In order to facilitate handling the various calendars stored within the PDA 100, each of the 10 calendars and associated scheduled matters may be stored in separate databases 150. Further, a common database 152 may be provided including a plurality of identification data sets each corresponding to the calendar of one of the calendar databases.

15 In one embodiment, each identification data set includes a system name, i.e. CAL0, CAL1, CAL2, etc.; a username, i.e. Willie Mills, Dave Davies, etc.; and a plurality of attributes. As shown in Figure 3C, such attributes may indicate that one of the calendars is selected, a primary calendar(default), read only, or a foreign calendar. It should be noted that the attributes may be selectively determined by the 20 user or automatically assigned depending on a source of the associated calendar. In use, the common database may be referenced to display the calendars of the calendar databases in accordance with the attributes. Further, the common database allows the scheduled matters to be shared among the calendar databases.

25 It should be noted that the data structure of Figure 3C is further critical for allowing the features of the present invention to be utilized with PDA's that are capable of handling only a single calendar. This backwards compatibility is enabled by allowing the data of each of the calendars including the original calendar to be stored independently. The correlation data in the form of attributes, on the other 30 hand, is stored in a separate common database.

Figure 4 shows a more detailed flowchart of the method of simultaneously depicting a plurality of the calendars on the display. In operation 400 of Figure 4, the primary calendar, as indicated by the attributes, is displayed, as shown in Figure 9A. Next, in decisions 402 and 404, a wait loop is executed until a multiple-view event, i.e. an event that requires the display of multiple calendars, is detected. If such event is not detected, the display continues normally in operation 406 of Figure 4. Note Figure 9A.

If, however, a multiple-view event is detected, it is then determined which type of multiple-view event has taken place. It should be noted that a multiple-view event may include the selection of the calendar select icon 128, one of the time increment icons 140, or the pull-down icon 134. If it is determined that one of the time increment icons 140 was selected in decision 404, the multiple views are handled in operation 408. If, on the other hand, it is determined that the calendar select icon 128 was selected in decision 404, the selected calendars are handled in operation 410. Finally, if it is determined that the pull-down icon 134 was selected in decision 404, the calendars are picked in operation 412. Additional details regarding operations 48, 410, and 412 will be set forth hereinafter with reference to Figures 5, 7, and 8.

Figure 5 is a more detailed flowchart delineating the method associated with the operation 408 shown in Figure 4 when one of the time increment icons 140 is selected. As shown in Figure 5, it is first determined which calendars are active, or selected, in operation 500 after which such active calendars are displayed side-by-side in operation 502 and divided into the time increments associated with the time increment icon that was selected. In other words, the calendar(s) is divided into increments of time corresponding to one of the time increment icons 140 that is currently selected. As an option, the selected icon may be altered, i.e. enlarged, upon a plurality of calendars being displayed simultaneously, wherein the selected time increment icon is augmented as a function of a number of the calendars being displayed simultaneously. Note, for example, Figures 9B and 9E.

With continuing reference to Figure 5, after the selected calendars are displayed, it is then determined in decision 504 whether the calendar select icon 128 has been selected. If so, the selected calendars are handled in operation 506. If not, 5 it is then determined in decision 508 whether a specific time, i.e. date, has been selected. If so, then a portion of the process is repeated. If a specific time is not determined in decision 508, it is determined in decision 510 whether one of the time increment icons 140 has been selected. If so, the present method ceases. If not, however, it is then determined whether a calendar heading 132 or an 10 event, i.e. scheduled matter, has been selected in decisions 512 and 514, respectively. Thereafter, the calendar heading 132 or event is handled in operations 516 and 518, respectively.

Figure 6 is a more detailed flowchart illustrating the method associated with 15 operation 516 shown in Figure 5. In particular, as shown in decision 600 of Figure 6, it is first determined whether there is more than one calendar displayed on the PDA 100 or, in other words, whether the present invention is operating in the third state 304 of Figure 3B. If the present invention is operating in the third state 304, details relating to the instant event, or scheduled matter, are presented in an 20 unillustrated pop-up window in operation 602. At that point, the user may decide whether to move the instant event in decision 604. If so, in operation 606, the event may be moved to another one of the simultaneously displayed calendars by dragging the scheduled matter on the display between the calendars using the stylus 106 or any other input device.

25 With continuing reference to Figure 6, it is shown that the events, or scheduled matters, of the calendars may be modified. This is accomplished by first determining whether the detail button 144 has been selected in decision 608. If it has, the event is displayed in operation 610 for modification if desired in operation 30 612.

Figure 7 is a more detailed flowchart delineating the method associated with operations 410 and 506 shown in Figures 4 and 5, respectively, when the calendar select icon 128 is selected. Upon such selection, a window 701 is displayed which identifies each of the calendars. Note Figures 9C and 9D. As indicated in decision 5 700 and operation 702, a user may select among the calendars by toggling through the identifiers and using the check boxes 703 of the window. Thereafter, the calendars may be edited, added, or moved in operations 704 using a new button 706, edit button 708, and a pair of arrow buttons 710.

10 Finally, Figure 8 is a more detailed flowchart delineating the method associated with operation 412 shown in Figure 4 when the pull-down icon 134 was selected. As shown, it is first determined whether the calendar associated with the pull-down icon 134 is a primary calendar in decision 800. If so, then any selected calendar is shown in addition to the primary calendar in operation 802. If, however, 15 the calendar associated with the pull-down icon 134 is not a primary calendar and there are not many calendars that are selected(1 or 2), then a pull-down window 803 is displayed in operation 804. Note Figure 9G. Thereafter, a new calendar may be selected in operation 806 after which such selected calendar replaces the previous calendar in operation 808 in the corresponding section of the display. Finally, the 20 pull-down window is disabled in operation 810.

With specific reference now to Figures 9A-9G, various graphical user interfaces are shown that may occur during use of the present invention. Figure 9A depicts a single calendar divided into increments of hours. As shown, the time 25 increment icons 140 of the time increment selector bar 136 are of a similar size when a single calendar is displayed.

Figure 9B shows a pair of calendars displayed simultaneously in a side-by-side relationship and each divided into increments of hours. It should be noted that 30 the time increment icon 140 that corresponds to the increments of hours is enlarged

since multiple calendars are displayed. Further, a time duration bar 900 is included for indicating a time period during which a scheduled matter is arranged.

5 Figure 9C depicts the full-size window 701 which displays all of the calendars available to be picked. As shown, checkboxes 703 are available to facilitate such selection. As mentioned earlier, in order for the full-size window 701 to be displayed, the calendar select icon 128 of Figure 3A must be selected. Figure 9D also shows the full-size window 701, but with an additional selected calendar. As shown, selection of a calendar is facilitated by way of a highlight bar 903

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Figure 9E depicts three calendars displayed simultaneously in a side-by-side relationship and each divided into increments of hours. As shown, the sections of each calendar are enlarged to compensate for the smaller areas in which the calendars are fitted. In the present display, the time increment icon 140 that 15 corresponds to the increments of hours is enlarged.

Figure 9F shows a single calendar similar to that of 9A with the exception of an open appointment icon 902 that indicates that a specific time period is open.

20 Figure 9G is an illustration showing the pull-down window 803 which may be accessed by selecting the pull-down icon 134. In one embodiment, the pull-down window requires only a part of the display 110 of the PDA 100. As shown, a currently selected calendar is indicated by way of a highlight bar 904.

25 While various embodiments have been described above, it should be understood that they have been presented by way of example only, and not limitation. Thus, the breadth and scope of a preferred embodiment should not be limited by any of the above described exemplary embodiments, but should be defined only in accordance with the following claims and their equivalents.